

DEATH VALLEY LOWER CARBONATE AQUIFER MONITORING PROGRAM- WELLS DOWN GRADIENT OF THE PROPOSED YUCCA MOUNTIAN NUCLEAR WASTE REPOSITORY

Revision – October 2006

PROJECT DESCRIPTION FOR A COOPERATIVE AGREEMENT WIT INYO COUNTY

1.0 Background and Introduction

Inyo County has participated in oversight activities associated with the Yucca Mountain Nuclear Waste Repository since 1987. The County has recently completed U.S. Department of Energy Cooperative Agreement DE-FC08-02RW12162. The work started under the first Cooperative Agreement was not completed, as the funding profile was less than the planned maximum amount. The overall goal of these studies was the evaluation of far-field issues related to potential transport, by ground water, of radionuclides into Inyo County, including Death Valley, and the evaluation of a connection between the Lower Carbonate Aquifer (LCA) and the biosphere.

The specific purpose of this proposed drilling program is to acquire geological, subsurface geology, and hydrologic data to:

1. Establish the existence of inter-basin flow between the Amargosa Basin and Death Valley Basin,
2. Characterize groundwater flow paths in the LCA through Southern Funeral Mountain Range,
3. Evaluate the hydraulic connection between the Yucca Mountain repository and the major springs in Death Valley through the LCA, and
4. Evaluate the hydraulic connection between the Yucca Mountain repository and Franklin Lake Playa.

The hydraulic characterization of the LCA is of interest to Inyo County for the following reasons:

1. The upward gradient in the LCA at Yucca Mountain provides a natural barrier to radionuclide transport,
2. The LCA is a necessary habitat resource for the endangered Devil's Hole pup fish, and
3. The LCA is the primary water supply and source of water to the major springs in Death Valley National Park.

The proposed program is for Inyo-BLM#1 and Inyo-BLM#2 wells, drilled during the previous Inyo/DOE Cooperative Agreement program, to be completed in the LCA, tested and sampled. Testing and monitoring in these wells will help to determine the source of groundwater in this area (See figure 1 below). Another LCA well is planned in the eastern side of the Funerals (making a total of three LCA wells on the eastern side) and one well is planned on the west side.

The program may expend some effort increasing the understanding of the hydrology of the Franklin Lake Playa, and its possible role as an end-point for long-term radionuclide transport into Inyo County through this shallow aquifer system. The program will consist of installation of shallow monitoring wells into Franklin Lake Playa, hydraulic testing and water chemical sampling and testing. Analyses will focus on a chemical source analysis of Franklin Lake Playa waters to up-gradient water systems in the Yucca Mountain area, and on the numerical modeling of this aquifer system. Relationships to this aquifer system and the LCA aquifer in the Death Valley area will be evaluated.

Inyo has been utilizing the previous data collected in the Death Valley Regional Flow System Model. Inyo also utilizes their own modeling to assist in understanding groundwater movement through the Paleozoic Carbonates from the Amargosa Valley through the Southern Funerals to the major spring in Death Valley.

Recent studies culminated in a MODFLOW groundwater model that is supported by the current program of:

- 1) Monitoring well drilling in the Southern Funeral Mountains (Inyo BLM #1 and #2, Travertine #2),
- 2) Surface and subsurface geologic mapping in the area, and 3) geophysical surveys.

Inyo County's primary concern for high level nuclear waste disposal at the Yucca Mountain repository is the far-field issues related to potential transport, by groundwater, of radionuclides into Inyo County, including Franklin Lake Playa and Death Valley, and the potential connection between the Upper Tertiary-age aquifer system and the Lower Carbonate Aquifer (LCA) to the biosphere. The relationship between carbonate spring waters in Death Valley (within Inyo County) and the groundwater flowing under Yucca Mountain has yet to be conclusively demonstrated. In addition, the "peak-dose" time frame, radionuclides from the proposed repository may reach Franklin Lake Playa, where they may be released to the environment through wind transport.

Additional geological and hydrological studies, defined in this proposed work plan, are important to help resolve Inyo County's concern for high-level nuclear waste disposal at the Yucca Mountain repository. Little is known about the hydraulic relationship between the Tertiary-age aquifers at Yucca Mountain and Franklin Lake Playa.

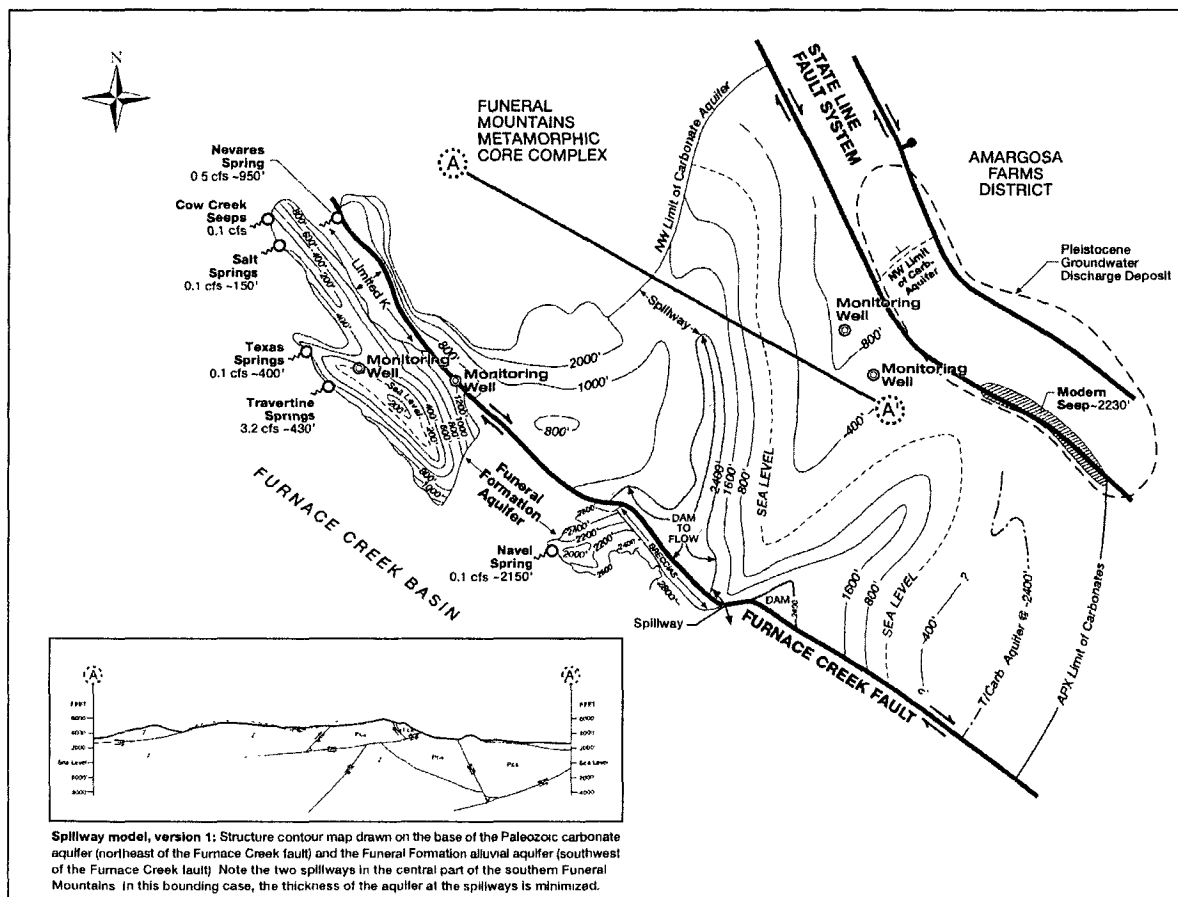


Figure 1. Structure contour map of the base of the Carbonate Aquifer formed by the fault planes with shallow dips. Note monitoring well locations.

The primary reason for the proposed wells is that limited subsurface hydrogeologic data exists on the LCA in the vicinity of the Funeral Mountains. Inyo-BLM #1 penetrated the LCA, but funding constraints prevented the completion of the well as a LCA monitoring well. The pump testing and water chemistry sampling of this well will provide critical data on the LCA. Inyo-BLM #2 well was cased approximately 1,500 feet above the contact with the LCA. The deepening and completion of this well will also provide critical data on the LCA. In addition, geologic constraints, coupled with hydrologic characterization of the flow-system, penetrated by the proposed three deep LCA wells will provide new information that will allow one to:

1. Evaluate regional groundwater flow through the southern Funeral Mountains,
2. Establish structural controls on flow-paths and discharge areas, and
3. Evaluating potential zones of mixing between deep, regional Lower Carbonate Aquifer groundwater and that derived locally from shallow groundwater systems to the northeast.

An additional reason for the proposed wells is that the geochemical, geological, and groundwater flow modeling studies (discussed above) strongly suggest that groundwater flows between the alluvial and carbonate aquifers both at Yucca Mountain and in Inyo County.

The groundwater flow models of the Death Valley flow system also indicate a need for subsurface data on the LCA in the southern Funeral Mountain range. The models of the Yucca Mountain area represent a reasonable interpretation of the geology of the area; however, they do not extend into the close vicinity of the Death Valley system. Inyo County investigations can provide additional information on the close proximity to Death Valley using the following methodologies:

1. Drilling data in the LCA,
2. Groundwater discharge measurements in Death Valley,
3. Surface and groundwater inflow data into Death Valley from the Amargosa River,
4. Infiltration measurements in mountains that adjoin Death Valley,
5. Direct data on the source of springs in Death Valley,
6. Water level monitoring data,
7. Hydraulic parameters of the associated aquifers, and
8. Information on hydraulic boundary conditions in Death Valley.

2.0 Scope of Work

This proposed DOE work plan is to drill out the casing in the lower part of the hole. Then we will complete the well with casing and a screen in the Carbonate Aquifer. A second well will be constructed in the Kelly Wells Formation aquifer in the Amargosa Desert basin sediments.

A second deep hole was drilled approximately 3 miles to the northwest of the first hole—BLM #2. The hole was drilled 2700 ft into the lower section of Tertiary-age sediments some distance above the Paleozoic rocks. The Amargosa Desert basin sediments are much thicker in this hole. The intent is to drill this hole deeper when our budget allows.

1. Completion of Inyo-BLM #1 and BLM #2 wells in the LCA, and associated pump testing
2. Drilling, completion, and testing of other deep LCA monitoring wells,
3. Drilling, completion, and testing of monitoring wells
4. Geophysical surveys through the southern Funeral Mountain range area,
5. Numerical modeling of the LCA and Development of a comprehensive hydrogeology database for Death Valley,
6. Conduct a hydrogeology and hydrochemical analysis of the Franklin Lake Playa area,
7. Geologic Mapping, and
8. Other Hydrologic monitoring and sampling as appropriate.

The rough schedule of planned work activities might look something like the following, depending on actual budgets, permits, schedules and available resources, and annual planning and funding.

Year 1

- | | |
|-------------------------------------|---------------|
| 1. Case Borehole Inyo-BLM#1 | TD 2,480 feet |
| 2. Deepen Borehole Inyo-BLM#2 | TD 4,200 feet |
| 3. Conduct Pump Testing | |
| 4. Geological & Geophysical Studies | |
| 5. Hydrologic Studies | |
| 6. Numerical Groundwater Modeling | |
| 7. Complete Well Permitting | |

Year 2

- | | |
|-------------------------------------|----------------|
| 1. Complete Pump Testing | |
| 2. Complete BLM # 3 | Est. 3000 feet |
| 3. Complete Echo # 3 | Est. 3000 feet |
| 4. Geological & Geophysical Studies | |
| 5. Hydrologic Studies | |
| 6. Numerical Groundwater Modeling | |

Year 3

- | | |
|---|--------------------|
| 1. Drill boreholes in Franklin Lake Playa | Est. 500 feet each |
| 2. Drill Borehole at Navares Spring | Est. 200 feet |
| 3. Geological & Geophysical Studies | |
| 4. Hydrologic Studies | |
| 5. Numerical Groundwater Modeling | |
| 6. Pump Testing & Sampling | |

Year 4

1. Geological & Geophysical Studies
2. Hydrologic Studies
3. Pump Testing & Sampling

Year 5

1. Geological & Geophysical Studies
2. Numerical Groundwater Modeling
3. Final Report Preparation
4. Pump Testing & Sampling

3.0 Requirements

All work performed by Inyo County will be in accordance with applicable State, local and Federal laws and regulations, and where applicable in accordance with Project requirements. Compliance with Yucca Mountain Office of Repository Development (ORD) and Nevada Test Site (NTS) procedures is mandatory for work performed on the NTS.

In general, when working at locations off the Nevada Test Site, Inyo County will work to its own technical, quality assurance, environmental, and health and safety program. A copy of the Inyo health and safety program for any piece of work will be made available to Project personnel upon request.

Work by Inyo County will not be subject to the OCWRM QARD. Data sets (if any) required to be "Q" will be collected by Project Participants working cooperatively with Inyo County under appropriate project procedures. In general, the data and information collected under this Cooperative Agreement will be south

of the regulatory boundary and accessible environment, and south of the southern extent of the site scale flow model. Data collected will be of interest to the Project as corroborative or analogous.

Inyo County shall submit an annual Technical Report summarizing the technical conclusions obtained.

Inyo County shall keep the project notified of ongoing work.

The Project intends to have substantial involvement in the planned work, including but not limited to observing activities, collecting core and/or cuttings samples from drilling, collecting water samples, conducting measurements for depth control in boreholes, curation and tracking of samples collected, etc. It is expected that Inyo and Project personnel will work cooperatively to accomplish these and any other desired cooperative activities and goals.

4.0 Responsibilities

Inyo County is responsible for carrying out this work in accordance with the terms and conditions of this cooperative agreement, and with applicable local, State and Federal laws and requirements. Inyo County and its subcontractors are responsible for carrying out the work in a safe, efficient and professional manner using good business and technical practices.